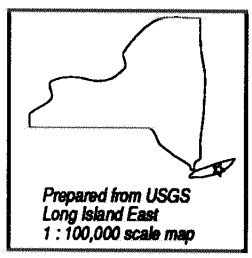
Brookhaven National Laboratory

Upton, New York
Region 2
NY7890008975

Site Exposure Potential

Brookhaven National Laboratory (BNL) is located on Long Island, New York, 97 km east of New York City (Figure 1). Lab facilities occupy a 680-hectare site within the 2,130-hectare BNL properties. BNL conducts research and development programs in high-energy, nuclear, and solid-state physics; fundamental material structure properties and interactions of matter; nuclear medicine; and the biological and chemical effects of radiation (U.S. Department of Energy 1988; Burns and Roe 1989).

Three hydraulically connected aquifer units make up a single zone of saturation located between 14 and 460 meters below the surface at the BNL site. This unconfined, composite aquifer is the primary drinking water source for Nassau and Suffolk counties, and has been designated by EPA as a sole-source aquifer. The groundwater from the BNL site generally flows east-southeast towards the Peconic River and its tributaries.



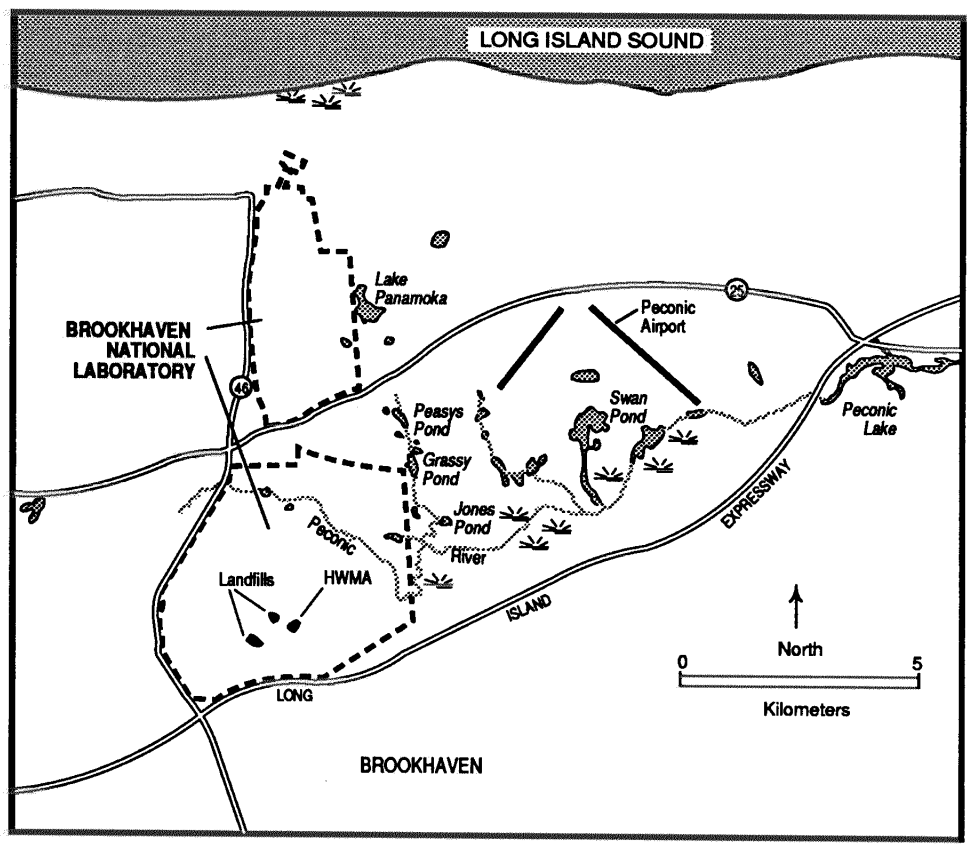


Figure 1. Brookhaven National Laboratory, Upton, New York.

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Site Exposure Potential, *cont.*

Areas of actual and potential soil, surface water, and groundwater contamination at BNL include active and inactive disposal areas, cesspools, abandoned drum sites, and areas with stained soil. Sources of contamination include the Hazardous Waste Management Area (HWMA), the central receiving and storage area for BNL hazardous, radioactive, mixed, and PCB wastes; landfills that have received hazardous and radioactive substances; and the former incinerator ash disposal area. Other areas of concern include the Meadow Marsh Study Area/Uplands Recharge Experiment where sewage effluent was disposed by land application; sewage treatment plant and sludge beds; an area where radionuclide-contaminated groundwater was pumped to a surface drainage course; an area where unidentified chemical containers were found; underground oil tanks; a detonation/burn area formerly used for burning and detonating highly explosive and reactive chemicals; underground radioactive wastewater storage tanks; and an oil and solvent spill area.

BNL is at the headwaters of the Peconic River watershed. Wetlands north and east of BNL drain to the tributaries of the Peconic River. The Peconic River flows to Flanders Bay, part of Great Peconic Bay in the New York Bight, approximately 27 km below the site.

Groundwater discharge to surface water and surface water runoff are the primary pathways of contaminant transport.

Site-Related Contamination

Soil, sediment, and surface water were not routinely monitored at BNL for chemical contaminants when the referenced reports were prepared. Trace elements detected in the groundwater and sewage effluent are presented in Table 1 (U.S. Department of Energy 1988; Burns and Roe 1989) along with AWQC.

Organic compounds were found at low levels in groundwater at BNL. Chloroethane, 1,1-dichloroethane, benzene, toluene, and ethylbenzene were detected at the HWMA area. Contaminants found in building cesspools included 1,1,1-trichloroethane, tetrachloroethane, toluene, and methyl chloride (U.S. Department of Energy 1988).

Site-Related Contamination, *cont.*

Radionuclides have been detected in both soil and groundwater at the BNL site. As a result of the Upland Recharge Experiment at the Meadow Marsh Study Area, groundwater was contaminated with tritium (U.S. Department of Energy 1988). Maximum radionuclide concentrations found in wells near the landfills in the west-central part of the site are presented as follows: Gross alpha: 19,460 pCi/l; cesium 137: 9,300 pCi/l; tritium: 49,000 pCi/l (Burns and Roe 1989).

Table 1. Maximum concentrations of major contaminants in groundwater and the sewage treatment plant effluent at the site.

	Groundwater µg/l	Sewage Treatment Plant Effluent µg/l	AWQC[1] µg/l
INORGANIC SUBSTANCE			
cadmium	25.6	NT	1.1+
chromium	24	NT	11
copper	125	400	12+
iron	131,500	600	1,000
lead	520	67	3.2+
mercury	< 0.2	NT	0.012
silver	10	50	0.12
zinc	8,150	300	110+

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1986)
\+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
NT Not analyzed

Radionuclide data reported in soil, sediment, vegetation, and fish are shown in Table 2 (U.S. Energy Research and Development Administration 1977; U.S. Department of Energy 1988). Although no criteria for the protection of aquatic organisms are available for radionuclides, sublethal effects have been established at levels ranging from 100 pCi/l to 1,000,000 pCi/l (Blaylock and Trablaka 1978).

Table 2. Maximum concentrations of radionuclides found in vegetation, soil, sediment, and fish on-site and in the Peconic River near the site.

	Peconic River			On-Site		
	Plants (unspecified)	Sediment	Fish (catfish)	Plants (grass)	Soil	Fish (Ponds)*
Year Collected	1973	1973	1973	1985	1985	1985
	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg
Radionuclide						
Be-7	879	NR	NR	2,030	740	NR
Co-60	274	< 50	< 50	NR	NR	NR
Sr-90	703	166	NR	NR	NR	3,328
Cs-137	1,109	1,907	1,355	111	924	581
U-238	NR	812	NR	NR	NR	NR
Th-232	NR	446	NR	NR	NR	NR
K-40	NR	NR	NR	4,960	6,100	NR
Th-228	NR	NR	NR	72	873	NR
Ra-226	NR	NR	NR	NR	657	NR
Hg-203	NR	NR	NR	NR	70	NR
Tritium	NR	NR	NR	NR	NR	1,742

NR: Not reported
* Brown bullhead and yellow perch were sampled

NOAA Trust Habitats and Species

Habitats with species of concern to NOAA include the Peconic River, Flanders Bay at the mouth of the Peconic River, and Great Peconic Bay (Table 3; Energy Research and Development Administration 1977; Weber personal communication 1990; Young personal communication 1990). Anadromous species, with the exception of the American eel, cannot migrate upstream in the Peconic River because of a low-level dam located at Riverhead, approximately 1.6 km upstream from the river mouth. A remnant of an alewife run still spawns at the base of the dam. Numerous estuarine and marine species occur in Flanders Bay near the mouth of the Peconic River and in Great Peconic Bay.

Table 3. Species and habitat use in the Peconic River near the mouth and in Flanders Bay.

Species		Habitat		
Common Name	Scientific Name	Spawning	Nursery	Adult Forage
ANADROMOUS/CATADROMOUS FISH				
alewife	*Alosa pseudoharengus*	◆	◆	◆
American eel	*Anguilla rostrata*		◆	
Atlantic menhaden	*Brevoortia tyrannus*		◆	◆
striped bass	*Morone saxatilis*		◆	◆
ESTUARINE/MARINE				
Fish				
bay anchovy	*Anchoa mitchelli*		◆	◆
weakfish	*Cynoscion regalis*		◆	◆
white perch	*Morone americana*			◆
bluefish	*Pomatomus saltatrix*		◆	◆
summer flounder	*Paralichthys dentatus*		◆	◆
butterfish	*Peprilus triacanthus*		◆	
winter flounder	*Psedopleuronectes americanus*	◆	◆	◆
Atlantic mackerel	*Scomber scombrus*		◆	
scup	*Stenotomus chrysops*		◆	◆
tautog	*Tautoga onitis*		◆	◆
Invertebrates				
blue crab	*Callinectes sapidus*	◆	◆	◆
hard clam	*Mercenaria mercenaria*	◆	◆	◆

Flanders Bay is a nursery area for many species of recreational and commercial importance, including winter flounder, tautog, scup, weakfish, Atlantic mackerel, bluefish, and butterfish (Weber personal communication 1990). Alewife, juvenile bluefish, and white perch are fished commercially at the mouth of the Peconic River.

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NOAA Habitats and Species, *cont.*

The New York State Department of Environmental Conservation is considering the possibility of restoring the alewife run in the Peconic River. Freshwater species that have been sampled in streams on the site include catfish, little pickerel, largemouth bass, bluegill sunfish, and banded sunfish.

References

Blaylock, B.G., and J.R. Trabalka. 1978. Evaluating the effects of ionizing radiation on aquatic organisms. In: Advances in Radiation Biology. J.T. Lett and H. Adler, eds. New York: Academic Press.

Burns and Roe. 1989. Draft RI/FS work plan, Brookhaven National Laboratory, Landfill Remedial Action Project. Brookhaven, New York: Associated Universities Incorporated, Safety and Environmental Protection Division.

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U.S. Environmental Protection Agency. 1986. Quality Criteria for Water. Washington, D.C.: Office of Water Regulations and Standards, Criteria and Standards Division. EPA 440/5-87-003.

Weber, A., Marine Finfish, Division of Marine Resources, New York State Department of Environmental Conservation, New York, New York, personal communication, August 6, 1990.

Young, B., Division of Marine Resources, New York State Department of Environmental Conservation, Stony Brook, New York, personal communication, August 1, 1990.